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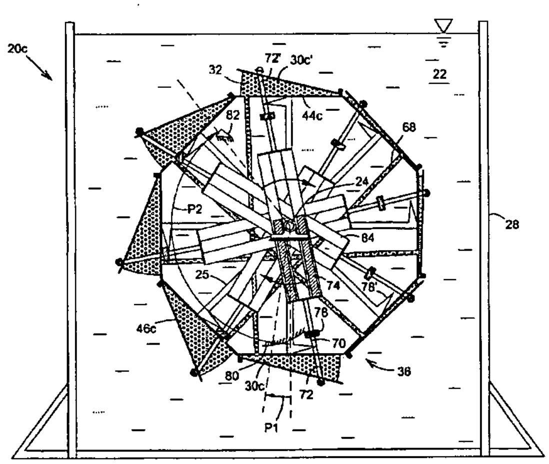

(57) Abstract: A buoyancy-activated motor (20) includes a plurality of deformable chambers (30) immersed within water (22) that extend generally radially outwardly from a horizontal shaft (24). A structure (28) rollably supports the shaft (24). Each chamber (30) is deformable between expanded and collapsed configurations so as to have a variable buoyancy relative to the water (22). Each chamber (30) has a center of gravity (31) located at first and second generally radial distances (D, D') from the shaft (24) when in the expanded and collapsed configurations, respectively. The first distance (D) is greater than the second distance (D'). The chambers (30) move generally upwardly and downwardly about the shaft (24) when in the expanded and collapsed configurations, respectively, so as to induce rotational movement of the shaft (24). A gas (32), lighter than an equal volume of water (22), is contained within the chambers (30) -that are in fluid communication with one another via connecting tubes (34). The chambers (30) are in their expanded and collapsed configurations during respective upward and downward movement thereof.

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BUOYANCY-ACTIVATED MOTOR

FIELD OF THE INVENTION

The present invention relates to the field of motors, and more particularly to pollution-free motor activated by buoyancy and gravity principles.

BACKGROUND OF THE INVENTION

Many devices and apparatuses have been developed in the past to generate power/energy by taking advantage of the gravity force and/or the buoyancy force to produce variable torque and induce rotation of a shaft.

US Patent 5,372,474 granted to Miller on December 13, 1994 discloses an apparatus for gravity assisted rotational motion that includes a plurality of fixed hollow arms rotatably supported on an axle itself supported on a frame. A hollow reservoir is mounted at each outer end of each arm. Each reservoir can be selectively filled or emptied of a heavy flowable material such as water. Depending on the location of a reservoir around the axle, a heavy plate alternatively tangentially closes or opens the reservoir as the device rotates. The transfer of water form one end of each arm to the other end induces the rotational movement. Due to the fixed position of the arms relative to the axle, important counter torque is induced by the reservoirs and plates being raised. Furthermore, one cannot control the rotational speed of such an apparatus that remains generally constant, as opposed to vary between a maximum speed and a minimum speed thereof.

PCT international application WO-99/37913 of Scibiorek published on July 29, 1999 discloses an energy turbine for gravity assisted rotational motion that includes a plurality of arms rotatably supported on an axle itself supported on a frame. A weight is mounted at each outer end of each arm. Each arm can slide radially relative to the axle to vary the radial distance of each weight relative to the axle to generate a resulting torque that induces the rotational motion of the axle. A ratchet/latch mechanism allow for alternately locking the arm in two opposed extreme positions, depending on the location of a weight around the axle. The sliding of each arm induces the rotational movement. Here again, one cannot control the rotational speed of such an apparatus that remains generally

constant. Furthermore, this apparatus has constant weights at the tip of each arm, thereby limiting the efficiency of the apparatus, as opposed to the use of variable weights (or buoyant bodies).

US Patent 3,934,964 granted to Diamond on January 27, 1976 discloses a gravity-actuated fluid displacement power generator using the gravitational force and the buoyancy force with floating bodies and weights secured to a chain and immersed into a fluid to induce the motion of the belt. The weights are displaced tangentially relative to the belt position similarly to the US Patent 5,372,474 above described, such that the center of gravity of each floating body/weight remains always at a same horizontal distance from the shaft during the ascent and descent displacements there about.

SUMMARY OF THE INVENTION

It is therefore a general object of the present invention to provide a motor that provides pollution-free energy.

An advantage of the present invention is that the buoyancy-activated motor uses simple physics principles to generate power.

A further advantage of the present invention is that the buoyancy-activated motor includes a track member that forces the deformation of the deformable chambers around a shaft such that they generate variable torques thereto.

Still another advantage of the present invention is that the buoyancy-activated motor includes deformable chambers having the distance between their center of gravity the shaft varying so as to increase the overall torque driving the shaft.

Still a further advantage of the present invention is that the buoyancy-activated motor includes deformable chambers that deform between an expanded configuration and a collapsed configuration upon upward and downward movement relative to a shaft, respectively.

Yet another advantage of the present invention is that the buoyancy-activated motor includes deformable chambers that deform either in a radial or axial direction relative to the shaft such that the centers of gravity are displaced relative to the shaft in the radial direction.

According to the present invention, there is provided a buoyancy-activated motor for generating power when immersed in a first fluid medium, the buoyancy-activated motor operatively connecting to a power generator, the buoyancy-activated motor comprises:

- a shaft being at least partially immersed in the first fluid medium, the shaft being generally horizontally oriented for operative connection to the power generator, the shaft defining a shaft longitudinal axis;

- a structure rollably supporting the shaft;

- deformable chambers being immersed in the first fluid medium, the deformable chambers connecting to and extending generally radially outwardly from the shaft, each of the deformable chambers being deformable between an expanded configuration and a collapsed configuration so as to have a variable buoyancy relative to the first fluid medium, the deformable chamber having a center of gravity at a first and a second generally radial distance from the shaft when in the expanded and collapsed configurations, respectively, the first generally radial distance being generally greater than the second generally radial distance, the deformable chambers moving generally upwardly and downwardly about the shaft when in the expanded and collapsed configurations, respectively, whereby the deformable chambers induce rotational movement of the shaft;

- a second fluid medium being contained within the deformable chambers, the second fluid medium being lighter than an equal volume of the first fluid medium;

- a chamber connecting means connecting between the deformable chambers so as to place the deformable chambers in fluid communication with one another;

- a chamber deforming means selectively deforming the deformable chambers in the expanded and collapsed configuration during upward and downward movement thereof, respectively.

Typically, the chamber deforming means includes:

- a chamber expansion means selectively deforming the deformable chambers from the collapsed configuration to the expanded configuration;

- a chamber collapsing means selectively deforming the deformable chambers from the expanded configuration to the collapsed configuration; and

- a chamber configuration holding means selectively maintaining the deformable chambers in the expanded and collapsed configuration during upward and downward movement thereof, respectively.

In one embodiment, the deformable chambers deform in a generally axial direction relative to the shaft between the expanded and collapsed configurations.

In one embodiment, the chamber deforming means includes a guiding rail, the guiding rail being generally fixed relative to the structure, the guiding rail operatively connecting to the deformable chambers so as to selectively deform the deformable chambers in the expanded and collapsed configuration during upward and downward movement thereof, respectively.

Typically, the guiding rail is configured to be variably axially positioned relative to the shaft with a circumferential position of the guiding rail relative to the shaft so as to induce deformation of the deformable chambers in the generally axial direction.

In one embodiment, each of the deformable chambers defines a chamber first end and a generally axially opposed chamber second end, the guiding rail operatively connecting to at least one of the chamber first and second ends so as to selectively displace the chamber first and second ends generally axially away from and toward one another during upward and downward movement thereof, respectively.

Typically, one of the chamber first and second ends operatively connects to the guiding rail, the other one of the chamber first and second ends being generally axially fixed about the generally axial direction.

In one embodiment, the guiding rail includes generally axially opposed first and second rail tracks, the first and second rail tracks operatively connecting to the chamber first and second ends, respectively, so as to selectively displace the chamber first and second ends generally axially away from and toward one another during upward and downward movement thereof, respectively.

In one embodiment, the deformable chambers deform in a generally radial direction relative to the shaft between the expanded and collapsed configurations.

Typically, each of the deformable chambers defines a chamber first end and a generally radially opposed chamber second end, the chamber deforming means operatively connecting to at least one of the chamber first and second ends so as to selectively displace the chamber first and second ends generally radially away from and toward one another during upward and downward movement thereof, respectively.

Typically, the chamber deforming means includes a guiding rail, the guiding rail being generally fixed relative to the structure, the guiding rail operatively connecting to at least one of the chamber first and second ends so as to selectively displace the chamber first and second ends generally radially away from and toward one another during upward and downward movement thereof, respectively.

Typically, the guiding rail is configured to be variably radially positioned relative to the shaft with a circumferential position of the guiding rail relative to the shaft so as to induce deformation of the deformable chambers in the generally radial direction.

Typically, the guiding rail operatively connecting to at least one of the chamber first and second ends so as to selectively displace the chamber first and second ends generally radially away from and toward one another during upward and downward movement thereof, respectively.

Typically, one of the chamber first and second ends operatively connects to the guiding rail, the other one of the chamber first and second ends being generally radially fixed about the generally radial direction.

In one embodiment, the deformable chambers are generally equally radially spaced from the shaft, the deformable chambers being generally equally spaced from one another in a generally circumferential direction.

Typically, each of the deformable chambers has a generally radially opposed one of the deformable chambers, each of the deformable chambers and the radially opposed one of the deformable chambers forming a chamber pair such that the deformable chambers form a plurality of the chamber pairs.

Typically, the chamber deforming means includes a connecting rod for each of the chamber pairs, the connecting rod defining generally longitudinally opposed rod first and second ends, the connecting rod being generally radially

oriented relative to the shaft, the connecting rod connecting to both the deformable chambers of each one of the chamber pairs so as to allow one of the deformable chambers to be in the collapsed configuration while the other of the deformable chambers is in the expanded configuration and to allow the deformable chambers to deform generally simultaneously.

Typically, the rod first and second ends connect to the chamber second end of respective the deformable chambers.

Typically, each of the connecting rods includes a weight member, the weight member displacing generally radially the connecting rod under gravity so as to simultaneously displace the chamber second end of one of the deformable chambers of each of the chamber pairs away from the corresponding chamber first end and displace the chamber second end of the other one of the deformable chambers of each of the chamber pairs toward the corresponding chamber first end.

Typically, each of the weight members is substantially located at equal distance from the rod first and second ends so as to reduce impact of the weight member on the rotational movement of the shaft.

Typically, the chamber deforming means further includes a lock mechanism for maintaining the deformable chambers in the expanded configuration during upward movement thereof when in a locked position, the lock mechanism allowing the deformable chambers to deform to the collapsed configuration when in an unlocked position, the lock mechanism mounting between the chamber first and second ends.

Typically, the lock mechanism is actuatable into the locked position by the connecting rod upon radial movement thereof under gravitational displacement of the weight member with the deformable chamber being in a first pre-determined angular position relative to the shaft in the expanded configuration, the lock mechanism being actuatable into the unlocked position by the deformable chamber being in a second pre-determined angular position relative to the shaft in the expanded configuration.

Typically, the lock mechanism is actuatable into a first and a second locked position by the connecting rod upon selective radial movement thereof under gravitational displacement of the weight member, the lock mechanism

being in the first and second locked positions when each of the deformable chambers of corresponding the chamber pair is in the expanded configuration, respectively.

Typically, each of the connecting rods includes a weight chamber, the weight chamber being substantially located at equal distance from the rod first and second ends, the weight chamber slidably receiving the weight member therein so as to allow the weight member to longitudinally move relative to the connecting rod, the weight chamber being configured and sized to allow the weight member to freely slide relative to the shaft radially away from corresponding the deformable chamber being in the expanded configuration when the connecting rod passes a substantially horizontal orientation.

Typically, the weight member is rollably mounted within the weight chamber.

Typically, the chamber first ends are generally radially fixed relative to the shaft, and each of the chamber second ends extends generally radially outwardly relative to respective the chamber first end.

In one embodiment, each of the chamber first ends defines a generally cylindrical-shaped sleeve, the cylindrical-shaped sleeve defining a sleeve axis, a hollowed cylindrical peripheral wall and a longitudinal end wall, the sleeve axis being generally radially oriented relative to the shaft, each of the chamber second ends being a piston slidably mounted within the peripheral wall.

Typically, the peripheral wall extends generally radially outwardly from corresponding the longitudinal end wall, the piston being in proximity to and away from corresponding the longitudinal end wall when in a first and a second limit position, respectively.

Typically, each of the connecting rods generally extends through the longitudinal end walls of the opposed deformable chambers of corresponding the chamber pair so as to connect to both the pistons of the opposed deformable chambers and allow one of the pistons to be in the first limit position while the other one of the pistons is in the second limit position.

In one embodiment, the shaft is a first shaft, the motor further including a second shaft rollably mounted on the structure, the second shaft being generally vertically spaced from the first shaft, the deformable chambers

connecting to and extending generally radially outwardly from the first and second shafts.

Typically, the first and second generally radial distances from the first and second shafts are first and second generally horizontal distances from the first and second shafts, respectively, the first generally horizontal distance being generally greater than the second generally horizontal distance.

Typically, the motor further includes a driving belt operatively connected to the first and second shafts, the driving belt supporting the deformable chambers.

Typically, the driving belt operatively meshes with the first and second shafts, and the deformable chambers are generally equally spaced from one another along the driving belt.

Typically, each of the deformable chambers has a generally opposed one of the deformable chambers, each of the deformable chambers and the opposed one of the deformable chambers forming a chamber pair such that the deformable chambers form a plurality of the chamber pairs.

In one embodiment, the chamber configuration holding means includes a lock mechanism for maintaining the deformable chambers in one of the expanded and collapsed configurations when in a locked position during upward and downward movement thereof, respectively, the lock mechanism allowing the deformable chambers to deform to the other one of the expanded and collapsed configurations when in an unlocked position, the lock mechanism mounting on the deformable chambers and operatively connecting to the structure.

Typically, the lock mechanism is actuatable into the locked position by corresponding the deformable chamber being in a first pre-determined angular position relative to the shaft in the one of the expanded and collapsed configurations, the lock mechanism being actuatable into the unlocked position by corresponding the deformable chamber being in a second pre-determined angular position relative to the shaft in the other one of the expanded and collapsed configurations.

In one embodiment, the lock mechanism is actuatable into a first and a second locked position by corresponding the deformable chamber being in

a first and a second pre-determined angular position relative to the shaft in the expanded and collapsed configuration, respectively, the lock mechanism being actuatable into the unlocked position by corresponding the deformable chamber being in a third and a fourth pre-determined angular position relative to the shaft in the collapsed and expanded configuration, respectively, the third and fourth pre-determined angular positions directly preceding the first and second pre-determined angular positions, respectively, so as to enable corresponding the deformable chamber to deform from the collapsed configuration to the expanded configuration and to deform from the expanded configuration to the collapsed configuration, respectively.

In one embodiment, the deformable chambers deform in a generally radial direction relative to the shaft between the expanded and collapsed configurations.

Typically, the chamber expansion means includes a wheel member, the wheel member freely rollably mounting on the structure about a wheel shaft, the wheel shaft being substantially parallel to the shaft, the wheel member selectively engaging the deformable chambers so as to selectively deform the deformable chambers from the collapsed configuration to the expanded configuration.

Typically, the wheel member is a sprocket wheel selectively engaging complementary rollers freely rollably mounted on the deformable chambers, and the sprocket wheel is operatively connected to the shaft so as to selectively actively deform the deformable chambers.

Alternatively, the sprocket wheel is a first sprocket wheel, the wheel shaft being a first wheel shaft, the chamber collapsing means including a second sprocket wheel, the second sprocket wheel freely rollably mounting on the structure about a second wheel shaft, the second wheel shaft being substantially parallel to the shaft, the second sprocket wheel selectively engaging the rollers of the deformable chambers so as to selectively deform the deformable chambers from the expanded configuration to the collapsed configuration.

In one embodiment, each of the deformable chambers defines a chamber first end and a generally opposed chamber second end, the chamber deforming means operatively connecting to at least one of the chamber first and

second ends so as to selectively displace the chamber first and second ends generally away from and toward one another during upward and downward movement thereof, respectively.

Typically, each of the chamber second ends is pivotally connected to respective the chamber first end that is generally fixed relative to the shaft.

Other objects and advantages of the present invention will become apparent from a careful reading of the detailed description provided herein, with appropriate reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the annexed drawings, like reference characters indicate like elements throughout.

Figure 1 is a sectioned side elevation view of a buoyancy-activated motor in accordance with an embodiment of the present invention;

Figure 2 is a partially broken enlarged section view taken along line 2-2 of Fig. 1, showing the chamber in expanded configuration;

Figure 3 is a partially broken enlarged section view taken along line 3-3 of Fig. 1, showing the chamber in collapsed configuration;

Figure 4 is a sectioned side elevation view of a buoyancy-activated motor in accordance with a second embodiment of the present invention;

Figure 5 is a partially broken enlarged section view taken along line 5-5 of Fig. 4, showing the chamber in expanded configuration;

Figure 6 is a partially broken enlarged section view taken along line 6-6 of Fig. 4, showing the chamber in collapsed configuration;

Figure 7 is a sectioned side elevation view of a buoyancy-activated motor in accordance with a third embodiment of the present invention;

Figure 8 is a sectioned side elevation view of a buoyancy-activated motor in accordance with a fourth embodiment of the present invention;

Figure 9 is a partially broken enlarged sectioned side elevation view of the embodiment of Fig. 8, showing details of the weight member;

Figure 10 is a sectioned side elevation view of a buoyancy-activated motor in accordance with a fifth embodiment of the present invention;

Figure 11 is a sectioned side elevation view of a buoyancy-activated motor in accordance with a sixth embodiment of the present invention, showing details of the piston-type deformable chambers;

Figure 12 is a sectioned side elevation view of the embodiment of Fig. 11 with an alternate chamber connecting means;

Figure 13 is a sectioned side elevation view of a buoyancy-activated motor in accordance with a seventh embodiment of the present invention, showing a vertically elongated embodiment;

Figure 14 is a sectioned side elevation view of a buoyancy-activated motor in accordance with an eighth embodiment of the present invention, showing different chamber expansion and collapsing means using a wheel member; and

Figure 15 is a sectioned side elevation view of the embodiment of Fig. 14, showing a sprocket wheel as an alternate wheel member.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the annexed drawings the preferred embodiments of the present invention will be herein described for indicative purposes and by no means as of limitation.

Throughout the following description, similar reference numerals identify similar components of the different embodiments.

Referring to Figs. 1 to 3, there is shown a buoyancy-activated motor 20 in accordance with a first embodiment of the present invention. The buoyancy-activated motor 20 generates power when it is immersed in a first fluid medium such as water 22 or the like. The motor 20 includes a shaft 24 at least partially immersed in water 22. The shaft 24 is substantially horizontally oriented and is generally connected to a power generator (not shown) or any machine for operation thereof. The shaft 24 defining a shaft longitudinal axis 26 is rollably supported by a structure 28 or the like. A plurality of deformable chambers 30, immersed in the water 22, connect to and extend generally radially outwardly from the shaft 24. Each deformable chamber 30 or container is deformable between an expanded or open configuration, shown on Fig. 2, and a collapsed or closed configuration, shown on Fig. 3, in order to have variable buoyancy relative

to the water 22. The deformable chambers 30 move generally upwardly and downwardly about the shaft 24 when in the expanded and collapsed configuration respectively to induce rotational movement of or drive the shaft 24.

This rotational movement is due to the fact that a second fluid medium such as air 32 or the like is contained within the chambers 30. Obviously, the second fluid medium (air 32) is lighter than an equal volume of the first fluid medium (water 22).

The motor 20 also includes a chamber connecting means 34 connecting between the deformable chambers 30 to place the latter in fluid communication with one another and allow the air 32 to flow between chambers 30. A chamber deforming means 36 selectively deforms the chambers 30 in the expanded and collapsed configuration during the upward and downward movement thereof, respectively.

Each deformable chamber 30 has its center of gravity 31 at a first and a second distance D, D' from the shaft 24 when in the expanded and collapsed configurations, respectively; the first distance D being generally greater than the second distance D'. The deformable chambers 30 have their center of gravity 31 being radially displaced relative to the shaft 24 between their expanded and collapsed configurations such that the respective torque applied to the shaft 24 varies to improve the power induced by the deformable chambers 30 and increase the overall efficiency of the motor 20. Accordingly, the center of gravity 31 of each deformable weight 30 is radially (and horizontally, about a vertical plane including the shaft longitudinal axis 26, for torque purpose) further away from the shaft 24 during its upward movement when it induces a generally positive torque than it is during its opposed downward movement when it induces a generally negative torque.

More specifically, the chamber deforming means 36 includes a chamber expansion means 38 that selectively deforms the chambers 30 from the collapsed to the expanded configuration, a chamber collapsing means 40 that selectively deforms the chambers 30 from the expanded to the collapsed configuration, and a chamber configuration holding means 42 that selectively maintains the chambers 30 in the expanded and/or collapsed configuration during upward and/or downward movement thereof, respectively.

In the embodiment of Figs. 1 to 3, the deformable chambers 30 are generally equally radially spaced from the shaft 24, and are generally equally spaced from one another in a generally circumferential direction all around the shaft 24. Typically, there is an even number of chambers 30 such that each chamber 30 defines a generally radially opposed chamber 30'; both the chamber 30 and its opposed chamber 30' form a chamber pair.

The deformable chambers 30 of Figs. 1 to 3 deform in a generally axial direction relative to the shaft 24. Each chamber 30 defines a chamber first end 44 and a generally axially opposed chamber second end 46. The chamber deforming means 36 operatively connects to at least one of, and typically both, the chamber first and second ends 44, 46 to selectively displace the latter generally axially away from and toward one another during upward and downward movement of the chamber 30, respectively. Obviously, the chamber first and second ends 44, 46, represented by generally rigid panels hingeably connected to the shaft 24, or its extension 25, are connected to one another via a water seal generally flexible interface 47 in order to allow relative displacement between the two without air leakage.

Typically, the chamber deforming means 36 includes a guiding rail 48 or the like that is generally fixed relative to the structure 28. The guiding rail 48 includes generally axially opposed first and second rail tracks 50, 52 that operatively connect to the chamber first and second ends 44, 46, respectively, to selectively displace the latter generally axially away from and toward each other during upward and downward movement thereof, respectively.

Preferably, the first and second rail tracks 50, 52 engage rollers 54 or the like mounted on the chamber first and second ends 44, 46. Both first and second tracks 50, 52, schematically represented in Fig. 1, typically extend all around the shaft 24 and each one includes a chamber expansion section 56, a chamber collapsing section 58, and chamber configuration holding sections 60 between the chamber expansion and collapsing sections 56, 58. Each track 50, 52 is configured to be variably axially positioned relative to the shaft 24 according to the circumferential or angular position of the guiding rail 48 relative to the shaft 24 to induce the deformation of the chambers 30 in the axial direction.

Typically, the first and second rail tracks 50, 52 are substantially a mirror image of each other, located on either sides of a virtual guiding plane (not shown) that is generally perpendicular to the shaft 24. Obviously, different sections of each track 50, 52 could either pull or push against the respective chamber first and second ends 44, 46 without departing from the scope of the present invention, as illustrated in dashed lines in Fig. 2.

All chambers 30 are in fluid communication with each other via a common air channel 62 or reservoir. In one embodiment, each chamber 30 is connected to the air channel 62 via a one-way valve 64 that allow the air 32 to freely exit the chamber 30 during collapsing thereof. On the other hand, the valve 64 needs to be de-activated to allow the air 32 to flow from the air channel 62 to the chamber 30 to expand the latter. The de-activation could therefore be provided by a conventional switch mechanism (not shown).

<u>Alternatives</u>

Referring to Figs. 4 to 6, there is shown a buoyancy-activated motor 20a in accordance with a second embodiment of the present invention and differing from the first embodiment 20 by the fact that all the deformable chambers 30a are connected to the adjacent ones so as to form a continuous chamber extending all around the shaft 24. The chamber 30a connects to the air channel 62 used to allow unobstructed flow of the air 32 therein.

For practicality purpose, the chamber first and second ends 44a, 46a are sealably connected to adjacent corresponding chamber first and second ends 44a, 46a to allow their successive deformation along the first and second rail tracks 50, 52.

The following embodiments detailed hereinafter include deformable chambers 30 that deform in a generally radial direction relative to the shaft 24 as opposed to the axial direction.

Referring to Fig. 7, there is shown a buoyancy-activated motor 20b in accordance with a third embodiment of the present invention. In this motor 20b, each deformable chamber 30b defines a chamber first end 44b and a generally radially opposed chamber second end 46b. The chamber deforming means 36 operatively connects to both chamber first and second ends 44b, 46b

to selectively displace the latter generally radially away from and toward one another during their upward and downward movement, respectively.

More specifically, the chamber first ends 44b are radially fixed relative to the shaft 24 while the chamber second ends 46b generally move in the radial direction, or extend radially outwardly, relative to the respective chamber first end 44b. Typically, each chamber second end 46b pivotally connects to its respective chamber first end 44b via a chamber deforming pivot 66.

Similarly, it would be obvious to one skilled in the art to have either the chamber first ends 44b radially moving relative to the shaft 24 and the chamber second ends 46b radially fixed thereto or both chamber first and second ends 44b, 46b radially moving relative to the shaft 24 without departing from the scope of the present invention.

The deformable chambers 30b are generally equally spaced around the shaft 24 and each one of them has a generally diametrically opposed one 30b', both forming a chamber pair.

The chamber deforming means 36 includes a guiding rail 48b generally fixed relative to the structure 28. The guiding rail 48b is configured to be variably radially positioned relative to the shaft 24 with its circumferential position about the shaft 24 so as to selectively induce deformation of the deformable chambers 30b in the radial direction.

The guiding rail 48b typically extends all around the shaft 24 and includes a chamber expansion section 56b adjacent the lowermost section thereof, a chamber collapsing section 58b adjacent the uppermost section thereof, and chamber configuration holding sections 60b between the chamber expansion and collapsing sections 56b, 58b. The chamber configuration holding sections 60b maintain the deformable chambers 30b in either the collapsed or the expanded configuration. Preferably, the guiding rail 48b engages rollers 54b or the like mounted on the chamber second ends 46b, the rollers 54b rolling freely about there respective axis generally parallel to the shaft longitudinal axis 26.

The chamber connecting means 34 typically includes a connecting tubing 68 or the like connected to both deformable chambers 30b, 30b' of each pair. The connecting tubing 68 typically allows the air 32 to freely flow between the two deformable chambers 30b, 30b'.

Accordingly, the chamber expansion and collapsing sections 56b, 58b of the chamber deforming means 38b are typically diametrically opposed to each other relative to the shaft 24. Hence, the deformable chamber 30b engaging the chamber expansion section 56b is filled by the air 32 being expulsed from the deformable chamber 30b' substantially simultaneously engaging the chamber collapsing section 58b through the connecting tubing 68.

Typically, the connecting tubing 68 is integrated into the hollowed shaft extensions 25 supporting the fixed chamber first ends 46b.

Referring to Fig. 8, there is shown a buoyancy-activated motor 20c in accordance with a fourth embodiment of the present invention.

In this embodiment 20c, the chamber deforming means 36 includes a connecting rod 70 for each chamber pair. Each connecting rod 70 defines generally longitudinally opposed rod first and second ends 72, 72' connected to the chamber second end 46c (radially moving end) of both deformable chambers 30c, 30c' of a chamber pair. The connecting rod 70, generally radially oriented relative to the shaft 24, forces simultaneous deformation of the two deformable chambers 30c, 30c' into the expanded and collapsed configurations, respectively. The connecting rod 70 also ensures that one 30c of the two deformable chambers connecting is maintained in the expanded configuration while the other one 30c' is maintained in the collapsed configuration.

As illustrated more specifically in Fig. 9, each connecting rod includes a weight member 74 typically located at equal distance from, or half way between, rod first and second ends 72, 72', adjacent the shaft 24 such that the impact of the weight member 74 on the rotational movement of the shaft 24 is minimized. The weight member 74 displaces the corresponding connecting rod 70 in a generally radial direction under gravity. The physical weight of the weight member 74 submerged in water 22 is obviously large enough to ensure the simultaneous expansion and collapsing of the two deformable chambers 30c, 30c' operatively connected thereto and undergoing some water pressure.

The chamber deforming means 36 further includes a lock mechanism 76 to maintain the deformable chambers 30c in the expanded configuration during upward movement thereof when in a locked position. The lock mechanism 76 allows the deformable chambers 30c to deform into the

collapsed configuration when in an unlocked position. The lock mechanism 76 mounts between the chamber first and second ends 44c, 46c. Typically, a lock 78 itself mounts on the connecting rod 70, fixed relative to the chamber second end 46c with its complementary part 78' fixed relative to the corresponding chamber first end 44c, while a lock latching component 80 mounts on the structure 28, radially fixed relative to the chamber first end 44c.

The lock latching component 80 preferably includes a small rail, located at a first pre-determined angular position P1 about the shaft longitudinal axis 26 (from any reference angle such as the downward direction), forcing the lock 78 to reach its locked position and its complementary part 78' by helping the weight member 74.

A lock unlatching component 82, located at a second pre-determined angular position P2 about the shaft longitudinal axis 26, forces the lock 78 to unlock from its complementary part 78' into its unlocked position and allow the weight member 74 to displace the connecting rod 70 accordingly, under gravity.

A lock 78 mounted on each rod first and second end 72, 72' is activated by the lock latching component 80 mounted on the structure 28 at the first pre-angular position P1 adjacent the lowermost position of the deformable chambers 30c, just before its upward movement relative to the shaft 24, as shown in Figs. 8 and 9.

The lock unlatching component 82 is located on the structure 28 at the second pre-determined angular position P2 adjacent the uppermost position of the deformable chambers 30c. The second pre-determined angular position P2 is substantially diametrically opposed to the first pre-determined angular position P1 such that the lock 78 of one of the deformable chamber 30c' is unlatched from its complementary part 78' to be in its unlocked position and allow the connecting rod 70 to slide radially downwardly with the weight member 74 to collapse the deformable chamber 30c' and simultaneously expand the opposed corresponding deformable chamber 30c, as illustrated by arrow A in Fig. 9. When the latter reaches is expanded configuration, the opposed lock 78 is latched to its complementary part 78' in its locked position by the lock latching component 80.

Alternatively, it would be obvious to one skilled in the art that only one lock 78 could be mounted on each actuating rod 70 without departing from the scope of the present invention. Accordingly, the lock 78 would be actuatable into a first and a second locked position when a same deformable chamber 30c reaches its expanded and collapsed configurations, respectively.

In order to minimize the impact of the weight member 74 onto the rotational movement of the shaft 24, each connecting rod 70 includes a weight chamber 84 or cavity. The weight chamber 84 slidably receives the weight member 74 therein so as to allow the latter to longitudinally move relative to the connecting rod 70. The weight chamber 84 is configured and sized to allow the weight member 74, under gravity, to freely slide radially relative to the shaft 24. Accordingly, the weight member 74 is allowed to freely move longitudinally along the connecting rod 70 away from the corresponding deformable chamber 30c being in its expanded configuration when the connecting rod 70 passes a substantially horizontal orientation H. When sliding across the shaft 24, the center of gravity 86 of the weight member 74 transfers to the horizontal opposite side of the shaft 24 relative to the expanded deformable chamber 30c to provide positive torque to the shaft 24, as shown by arrows B in Fig. 9.

Typically, the weight member 74 is rollably mounted within the weight chamber 84 using weight rollers 88 or the like. Although the weight chamber 84 is shown as being closed and sealed, it could alternatively be opened so as to minimize its buoyancy effect that would require a slightly heavier weight member 74.

Referring to Fig. 10, there is shown a buoyancy-activated motor 20d in accordance with a fifth embodiment of the present invention.

The motor of the fifth embodiment 20d is similar to the fourth embodiment 20c except that the chamber deforming means 36 further includes a chamber expansion section 56d and a chamber collapsing section 58d of a guiding rail 48d to help displacing the connecting rods 70 for the deformable chambers 30d to reach their corresponding expanded and collapsed configurations, respectively.

The chamber expansion and collapsing sections 56d, 58d operatively connect to the respective chamber rollers 54d and could be used as a backup to the lock mechanism 76 activated by the weight members 74.

Now referring to Fig. 11, there is shown a buoyancy-activated motor 20e in accordance with a sixth embodiment of the present invention.

As opposed to the above described embodiments 20, 20a, 20b, 20c and 20d wherein each chamber second end 46 pivotally connects to its respective chamber first end 44 via a chamber deforming pivot 66, each chamber second end 46e slidably moves relative to its respective chamber first end 44e in a generally radial direction relative to the shaft 24. Each chamber second end 46e moves between first and second limit positions corresponding to the expanded and collapsed configurations of the deformable chamber 30e, respectively.

Typically, each chamber first end 44e, fixed relative to the shaft 24 although not specifically illustrated in Fig. 11, defines a generally cylindrical-shaped sleeve 90. The cylindrical-shaped sleeve 90 defines a sleeve axis 92, a hollowed cylindrical peripheral wall 94 and a longitudinal end wall 96. The sleeve axis 92 is generally radially oriented relative to the shaft 24. Each chamber second end 46e is a piston 98 slidably mounted within the corresponding peripheral wall 94.

Each peripheral wall 94 extends generally radially outwardly from the corresponding longitudinal end wall 96 such that the piston 98 is in proximity to and away from the corresponding end wall 96 when in a first and a second limit position, respectively.

Typically, each connecting rod 70e generally extends through the end walls 96 of the opposed deformable chambers 30e of the corresponding chamber pair so as to connect to both pistons 98 thereof and allow one of the pistons 98 to be in the first limit position while the other one is in the second limit position.

A connecting tubing 68e connects to both opposed deformable chambers 30e of each chamber pair, typically through the end walls 96, to allow fluid communication between the two deformable chambers 30e.

Referring to Fig. 12, there is shown an alternate chamber connecting means 34 in which each connecting rod 70e is generally hollowed and typically radially opened at both rod first and second ends 72e, 72e' at the interface with the chamber second ends 46e to allow fluid communication between the opposed deformable chambers 30e of the chamber pair.

Although not shown in Figs. 11 and 12, the chamber deforming means 36 of the motor 20e typically includes a lock mechanism 76 and weight members 74, the latter being included in the pistons 98 and/or the connecting rod 70. Also in Fig. 12, it is to be noted that the chamber first ends 44e are not all shown as being fixed to the shaft extension 25 for clarity purpose only.

Now referring to Fig. 13, there is shown a buoyancy-activated motor 20f in accordance with a seventh embodiment of the present invention which is a generally vertically elongated embodiment.

The motor 20f includes a first shaft 24 and a second shaft 24' rollably mounted on the structure 28. The second shaft 24' is generally vertically spaced from the first shaft 24 and defines a second shaft longitudinal axis 26'. The deformable chambers 30f connect to and extend generally radially outwardly from both the first and second shafts 24, 24'.

The motor 20f further includes a driving belt 100 operatively connected to the first and second shafts 24, 24', via the shaft extensions 25, 25' or belt wheels, support the deformable chambers 30f. Typically, the driving belt 100 operatively meshes with the first and second belt wheels 25, 25'. Accordingly, the chamber first ends 44f preferably have a slightly concave shape such that the substantially follow the shape of the driving belt 100 when it passes around the belt wheels 25, 25'.

Typically, as in the previous described embodiments, the deformable chambers 30f are generally equally spaced from one another along the driving belt 100. Also, each deformable chamber 30f has a generally "diametrically" opposed deformable chamber 30f', both forming a chamber pair, and in fluid communication with each other via a connecting tubing 68f.

Each deformable chamber 30f has its center of gravity 31 at a first and a second horizontal distance Dh, Dh' from a vertical plane including the shaft longitudinal axes 26, 26' when in the expanded and collapsed configurations,

respectively; the first horizontal distance Dh being generally greater than the second horizontal distance Dh'. The deformable chambers 30f have their center of gravity 31 being "radially" horizontally displaced relative to the vertical plane including the shaft longitudinal axes 26, 26' between their expanded and collapsed configurations such that the respective torque applied to the first and second shafts 24, 24' varies to improve the power induced by the deformable chambers 30f and increase the overall efficiency of the motor 20f. Accordingly, the center of gravity 31 of each deformable weight 30f is horizontally (about the first and second shafts 24, 24' for torque purpose) further away from the vertical plane during its upward movement when it induces a generally positive torque than it is during its opposed downward movement when it induces a generally negative torque.

The chamber configuration holding means 42 includes a lock mechanism 76f to maintain the deformable chambers 30f in both the expanded and collapsed configurations when in a first and a second locked position respectively during upward and downward movement thereof, respectively. The lock mechanism 76f includes a lock 78f mounted between corresponding chamber first and second ends 44f, 46f, and first and second lock latching components 80f, 80f' mounted on the structure 28 and corresponding first and second lock unlatching components 82f, 82f' also mounted on the structure 28. When in the unlocked position, the lock mechanism 76f allows the deformable chambers 30f to deform from one of the expanded and collapsed configurations to the other.

Each lock 78f is actuatable into the first and second locked positions by the first and second lock latching components 80f, 80f' positioned at a first and a second pre-determined angular position P1, P1' relative to the first shaft 24, respectively, when the deformable chambers 30f reach their expanded and collapsed configurations, respectively. In a similar manner, the lock 78f mechanism is actuatable into the unlocked position by the corresponding first and second lock unlatching components 82f, 82f' positioned at a third and a fourth pre-determined angular position P2, P2' relative to the first shaft 24, respectively, when the deformable chambers 30f are in their collapsed and expanded configurations, respectively. The third and fourth pre-determined angular

positions P2, P2' generally directly precede the first and second pre-determined angular positions P1, P1', respectively, such that the corresponding deformable chambers 30f deform from the collapsed configuration to the expanded configuration and deform from the expanded configuration to the collapsed configuration, respectively.

Generally, the first and second predetermined angular positions P1, P1' are substantially "diametrically" opposed to each other relative to the first shaft 24. Similarly, the third and fourth predetermined angular positions P2, P2' are substantially "diametrically" opposed to each other relative to the first shaft 24.

Furthermore, the chamber collapsing means 40 generally includes a chamber collapsing section 58f of a guiding rail 48f operatively connecting to chamber rollers 54f rollably mounted on corresponding chamber second ends 46f. The chamber collapsing section 58f extend generally between the fourth and the second pre-determined angular positions P2', P1'.

The chamber expansion means 38 generally includes a chamber expansion section 56f of a guiding rail 48f operatively connecting to chamber rollers 54f rollably mounted on corresponding chamber second ends 46f. The chamber expansion section 56f extend generally between the third and the first pre-determined angular positions P2, P1.

Furthermore, the chamber expansion means 38 further includes chamber connecting rods 70f selectively, releasably and operatively connecting to the chamber second ends 46f at its rod first and second ends 72f, 72f'. The connecting rods 70f are radially slidably mounted on the first shaft 24 located adjacent the chamber expansion means 38. Each connecting rod 70f preferably includes a weight member 74 mounted within a weight chamber 84, as described hereinabove for embodiment 20c.

Now referring to Fig. 14, there is shown a buoyancy-activated motor 20g in accordance with an eighth embodiment of the present invention.

The chamber configuration holding means 42 includes continuous chamber configuration holding sections 60g of the guiding rail 48g to maintain the deformable chambers 30g in their expanded and collapsed configurations during upward and downward movement thereof, respectively.

Furthermore, instead of the chamber connecting rods 70, the chamber expansion section 56g of the chamber deforming means 36 includes a chamber deforming wheel member 102. The wheel member 102 is mounted on a wheel shaft 104 itself rollably mounted on the structure 28; the wheel shaft 104 being generally parallel to the first shaft 24. The wheel member 102 selectively and operatively engages the deformable chambers 30g such that it selectively deforms the deformable chambers 30g from their collapsed configuration to their expanded configuration. Preferably, the wheel shaft 104 is operatively driven by the first shaft 24 using a wheel chain 106 or the like, as shown in dashed lines in Fig. 14.

Similarly, the chamber collapsing section 58g of the chamber deforming means 36 includes a second chamber deforming wheel member 102' mounted on a second wheel shaft 104' itself rollably mounted on the structure 28. The second wheel shaft 104', generally parallel to the second second shaft 24', is typically operatively driven by the second shaft 24' using a second wheel chain 106' or the like via a sprocket gear 108, as shown in dashed lines in Fig. 14. The second wheel member 102' selectively and operatively engages the deformable chambers 30g such that it selectively deforms the deformable chambers 30g from their expanded configuration to their collapsed configuration.

Similarly, it would be obvious to one skilled in the art that the wheel members 102, 102' could be driven by external motors (not shown) without departing from the scope of the present invention.

Now referring to Fig. 15, there is shown alternate wheel members that are sprocket wheels 102g, 102g' with corresponding wheel teeth 110, 110' to selectively engage the complementary rollers 54g freely rollably mounted on the chamber second ends 46g; the chamber first ends 44g remaining fixed relative to the driving belt 100.

The rotational speed of the motor 20 to 20g can be controlled by varying the air pressure level inside the deformable chambers 30 and/or the water level inside the structure 28 such that the deformable chambers 30 at least partially come out of the water 22 when reaching the upper region of their travel path around the shaft(s) 24.

Obviously, all mechanisms of the present invention preferably include bushings, rollers or the like (not always shown) to reduce friction wherever possible, and the shape of the chambers 30 are such that the drag force they generate when being displaced within the first fluid medium 22 is minimized. Similarly, it would be obvious to one skilled in the art that some required structural elements are not specifically shown for the purpose of improving the clarity of the Figs. 1 through 15, without departing from the scope of the present invention.

Although the present buoyancy-activated motor has been described with a certain degree of particularity, it is to be understood that the disclosure has been made by way of example only and that present invention is not limited to the features of the embodiments described and illustrated herein, but includes all variations and modifications within the scope and spirit of the present invention as hereinafter claimed.

CLAIMS

1. A buoyancy-activated motor (20) for generating power when immersed in a first fluid medium (22), said buoyancy-activated motor (20) operatively connecting to a power generator, said buoyancy-activated motor (20) comprising:

- a shaft (24) being at least partially immersed in said first fluid medium (22), said shaft (24) being generally horizontally oriented for operative connection to the power generator, said shaft (24) defining a shaft longitudinal axis (26);

- a structure (28) rollably supporting said shaft (24);

- deformable chambers (30) being immersed in said first fluid medium (22), said deformable chambers (30) connecting to and extending generally radially outwardly from said shaft (24), each of said deformable chambers (30) being deformable between an expanded configuration and a collapsed configuration so as to have a variable buoyancy relative to said first fluid medium (22), said deformable chamber (30) having a center of gravity (31) at a first and a second generally radial distance (D) from said shaft (D') when in said expanded and collapsed configurations, respectively, said first generally radial distance (D) being generally greater than said second generally radial distance (D'), said deformable chambers (30) moving generally upwardly and downwardly about said shaft (24) when in said expanded and collapsed configurations, respectively, whereby said deformable chambers (30) induce rotational movement of said shaft (24);

- a second fluid medium (32) being contained within said deformable chambers (30), said second fluid medium (32) being lighter than an equal volume of said first fluid medium (22);

- a chamber connecting means (34) connecting between said deformable chambers (30) so as to place said deformable chambers (30) in fluid communication with one another;

- a chamber deforming means (36) selectively deforming said deformable chambers (30) in said expanded and collapsed configuration during upward and downward movement thereof, respectively.

2. The motor (20) of claim 1, wherein said chamber deforming means (36) includes:

- a chamber expansion means (38) selectively deforming said deformable chambers (30) from said collapsed configuration to said expanded configuration;

- a chamber collapsing means (40) selectively deforming said deformable chambers (30) from said expanded configuration to said collapsed configuration; and

- a chamber configuration holding means (42) selectively maintaining said deformable chambers (30) in said expanded and collapsed configuration during upward and downward movement thereof, respectively.

3. The motor (20) of claim 1, wherein said deformable chambers (30) deform in a generally axial direction relative to said shaft (24) between said expanded and collapsed configurations.

4. The motor (20) of claim 3, wherein said chamber deforming means (36) includes a guiding rail (48), said guiding rail (48) being generally fixed relative to said structure (28), said guiding rail (48) operatively connecting to said deformable chambers (30) so as to selectively deform said deformable chambers (30) in said expanded and collapsed configuration during upward and downward movement thereof, respectively.

5. The motor (20) of claim 4, wherein said guiding rail (48) is configured to be variably axially positioned relative to said shaft (24) with a circumferential position of said guiding rail (48) relative to said shaft (24) so as to induce deformation of said deformable chambers (30) in said generally axial direction.

6. The motor (20) of claim 4, wherein each of said deformable chambers (30) defines a chamber first end (44) and a generally axially opposed chamber second end (46), said guiding rail (48) operatively connecting to at least one of said chamber first and second ends (44, 46) so as to selectively displace said chamber first and second ends (44, 46) generally axially away from and

toward one another during upward and downward movement thereof, respectively.

7. The motor (20) of claim 6, wherein one of said chamber first and second ends (44, 46) operatively connects to said guiding rail (48), the other one of said chamber first and second ends (44, 46) being generally axially fixed about said generally axial direction.

8. The motor (20) of claim 6, wherein said guiding rail (48) includes generally axially opposed first and second rail tracks (50, 52), said first and second rail tracks (50, 52) operatively connecting to said chamber first and second ends (44, 46), respectively, so as to selectively displace said chamber first and second ends (44, 46) generally axially away from and toward one another during upward and downward movement thereof, respectively.

9. The motor (20) of claim 8, wherein guiding rail (48) defines a guiding plane generally perpendicular to said shaft (24), said first and second rail tracks (50, 52) being on either side of said guiding plane, said second rail track (52) being substantially a mirror image of said first rail track (50) about said guiding plane.

10. The motor (20) of claim 1, wherein said deformable chambers (30) deform in a generally radial direction relative to said shaft (24) between said expanded and collapsed configurations.

11. The motor (20) of claim 10, wherein each of said deformable chambers (30) defines a chamber first end (44) and a generally radially opposed chamber second end (46), said chamber deforming means (36) operatively connecting to at least one of said chamber first and second ends (44, 46) so as to selectively displace said chamber first and second ends (44, 46) generally radially away from and toward one another during upward and downward movement thereof, respectively.

12. The motor (20) of claim 11, wherein said chamber deforming means (36) includes a guiding rail (48), said guiding rail (48) being generally fixed relative to said structure (28), said guiding rail (48) operatively connecting to at least one of said chamber first and second ends (44, 46) so as to selectively displace said chamber first and second ends (44, 46) generally radially away from and toward one another during upward and downward movement thereof, respectively.

13. The motor (20) of claim 12, wherein said guiding rail (48) is configured to be variably radially positioned relative to said shaft (24) with a circumferential position of said guiding rail (48) relative to said shaft (24) so as to induce deformation of said deformable chambers (30) in said generally radial direction.

14. The motor (20) of claim 13, wherein said guiding rail (48) operatively connecting to at least one of said chamber first and second ends (44, 46) so as to selectively displace said chamber first and second ends (44, 46) generally radially away from and toward one another during upward and downward movement thereof, respectively.

15. The motor (20) of claim 14, wherein one of said chamber first and second ends (44, 46) operatively connects to said guiding rail (48), the other one of said chamber first and second ends (44, 46) being generally radially fixed about said generally radial direction.

16. The motor (20) of claim 11, wherein said deformable chambers (30) are generally equally radially spaced from said shaft (24), said deformable chambers (30) being generally equally spaced from one another in a generally circumferential direction.

17. The motor (20) of claim 16, wherein each of said deformable chambers (30) has a generally radially opposed one of said deformable chambers (30'), each of said deformable chambers (30) and said radially

opposed one of said deformable chambers (30') forming a chamber pair such that said deformable chambers (30, 30') form a plurality of said chamber pairs.

18. The motor (20) of claim 17, wherein said chamber deforming means (36) includes a connecting rod (70) for each of said chamber pairs, said connecting rod (70) defining generally longitudinally opposed rod first and second ends (72, 72'), said connecting rod (70) being generally radially oriented relative to said shaft (24), said connecting rod (70) connecting to both said deformable chambers (30, 30') of each one of said chamber pairs so as to allow one of said deformable chambers (30') to be in said collapsed configuration while the other of said deformable chambers (30) is in said expanded configuration and to allow said deformable chambers (30, 30') to deform generally simultaneously.

19. The motor (20) of claim 18, wherein said rod first and second ends (72, 72') connect to said chamber second end (46) of respective said deformable chambers (30, 30').

20. The motor (20) of claim 19, wherein each of said connecting rods (70) includes a weight member (74), said weight member (74) displacing generally radially said connecting rod (70) under gravity so as to simultaneously displace said chamber second end (46) of one of said deformable chambers (30) of each of said chamber pairs away from said corresponding chamber first end (44) and displace said chamber second end (46) of the other one of said deformable chambers (30') of each of said chamber pairs toward said corresponding chamber first end (44).

21. The motor (20) of claim 20, wherein each of said weight members (74) is substantially located at equal distance from said rod first and second ends (72, 72') so as to reduce impact of said weight member (74) on said rotational movement of said shaft (24).

22. The motor (20) of claim 21, wherein said chamber deforming means (36) further includes a lock mechanism (76) for maintaining said

deformable chambers (30) in said expanded configuration during upward movement thereof when in a locked position, said lock mechanism (76) allowing said deformable chambers (30) to deform to said collapsed configuration when in an unlocked position, said lock mechanism (76) mounting between said chamber first and second ends (44, 46).

23. The motor (20) of claim 22, wherein said lock mechanism (76) is actuatable into said locked position by said connecting rod (70) upon radial movement thereof under gravitational displacement of said weight member (74) with said deformable chamber (30) being in a first pre-determined angular position (P1) relative to said shaft (24) in said expanded configuration, said lock mechanism (76) being actuatable into said unlocked position by said deformable chamber (30) being in a second pre-determined angular position (P1') relative to said shaft (24) in said expanded configuration.

24. The motor (20) of claim 23, wherein said lock mechanism (76) is actuatable into a first and a second locked position by said connecting rod (70) upon selective radial movement thereof under gravitational displacement of said weight member (74), said lock mechanism (76) being in said first and second locked positions when each of said deformable chambers (30) of corresponding said chamber pair is in said expanded configuration, respectively.

25. The motor (20) of claim 24, wherein said each of said connecting rods (70) includes a weight chamber (84), said weight chamber (84) being substantially located at equal distance from said rod first and second ends (72, 72'), said weight chamber (84) slidably receiving said weight member (74) therein so as to allow said weight member (74) to longitudinally move relative to said connecting rod (70), said weight chamber (84) being configured and sized to allow said weight member (74) to freely slide relative to said shaft (24) radially away from corresponding said deformable chamber (30) being in said expanded configuration when said connecting rod (70) passes a substantially horizontal orientation.

26. The motor (20) of claim 25, wherein said weight member (74) is rollably mounted within said weight chamber (84).

27. The motor (20) of claim 26, wherein said chamber first ends (44) are generally radially fixed relative to said shaft (24).

28. The motor (20) of claim 27, wherein each of said chamber second ends (46) extends generally radially outwardly relative to respective said chamber first end (44).

29. The motor (20) of claim 1, wherein said shaft is a first shaft (24), said motor (20) further including a second shaft (24') rollably mounted on said structure (28), said second shaft (24') being generally vertically spaced from said first shaft (24), said deformable chambers (30) connecting to and extending generally radially outwardly from said first and second shafts (24, 24').

30. The motor (20) of claim 29, wherein said first and second generally radial distances (D, D') from said first and second shafts (24, 24') are respective first and second generally horizontal distances (Dh, Dh') from said first and second shafts (24, 24'), said first generally horizontal distance (Dh) being generally greater than said second generally horizontal distance (Dh').

31. The motor (20) of claim 30, further including a driving belt (100) operatively connected to said first and second shafts (24, 24'), said driving belt (100) supporting said deformable chambers (30).

32. The motor (20) of claim 31, wherein said driving belt (100) operatively meshes with said first and second shafts (24, 24').

33. The motor (20) of claim 31, wherein said deformable chambers (30) are generally equally spaced from one another along said driving belt (100).

34. The motor (20) of claim 33, wherein each of said deformable chambers (30) has a generally opposed one of said deformable chambers (30'), each of said deformable chambers (30) and said opposed one of said deformable chambers (30') forming a chamber pair such that said deformable chambers (30, 30') form a plurality of said chamber pairs.

35. The motor (20) of claim 34, wherein said chamber connecting means (34) connecting between said deformable chambers (30, 30') of each of said chamber pairs so that said deformable chambers (30, 30') of each of said chamber pairs are in fluid communication with one another.

36. The motor (20) of claim 1, wherein said deformable chambers (30) are generally equally radially spaced from said shaft (24), said deformable chambers (30) being generally equally spaced from one another in a generally circumferential direction.

37. The motor (20) of claim 36, wherein each of said deformable chambers (30) defines a generally radially opposed one of said deformable chambers (30'), each of said deformable chambers (30) and said radially opposed one of said deformable chambers (30') forming a chamber pair such that said deformable chambers (30, 30') form a plurality of said chamber pairs.

38. The motor (20) of claim 37, wherein said chamber connecting means (34) connecting between said deformable chambers (30, 30') of each of said chamber pairs so that said deformable chambers (30, 30') of each of said chamber pairs are in fluid communication with one another.

39. The motor (20) of claim 2, wherein said chamber configuration holding means (42) includes a lock mechanism (76) for maintaining said deformable chambers (30) in one of said expanded and collapsed configurations when in a locked position during upward and downward movement thereof, respectively, said lock mechanism (76) allowing said deformable chambers (30) to deform to the other one of said expanded and collapsed configurations when in

an unlocked position, said lock mechanism (76) mounting on said deformable chambers (30) and operatively connecting to said structure (28).

40. The motor (20) of claim 39, wherein said lock mechanism (76) is actuatable into said locked position by corresponding said deformable chamber (30) being in a first pre-determined angular position (P1) relative to said shaft (24) in said one of said expanded and collapsed configurations, said lock mechanism (76) being actuatable into said unlocked position by corresponding said deformable chamber (30) being in a second pre-determined angular position (P2) relative to said shaft (24) in the other one of said expanded and collapsed configurations.

41. The motor (20) of claim 39, wherein said lock mechanism (76) is actuatable into a first and a second locked position by corresponding said deformable chamber (30) being in a first and a second pre-determined angular position (P1, P1') relative to said shaft (24) in said expanded and collapsed configuration, respectively, said lock mechanism (76) being actuatable into said unlocked position by corresponding said deformable chamber (30) being in a third and a fourth pre-determined angular position (P2, P2') relative to said shaft (24) in said collapsed and expanded configuration, respectively, said third and fourth pre-determined angular positions (P2, P2') directly preceding said first and second pre-determined angular positions (P1, P1'), respectively, so as to enable corresponding said deformable chamber (30) to deform from said collapsed configuration to said expanded configuration and to deform from said expanded configuration to said collapsed configuration, respectively.

42. The motor (20) of claim 2, wherein said deformable chambers (30) deform in a generally radial direction relative to said shaft (24) between said expanded and collapsed configurations.

43. The motor (20) of claim 42, wherein said chamber expansion means (38) includes a wheel member (102), said wheel member (102) freely rollably mounting on said structure (28) about a wheel shaft (104), said wheel

shaft (104) being substantially parallel to said shaft (24), said wheel member (102) selectively engaging said deformable chambers (30) so as to selectively deform said deformable chambers (30) from said collapsed configuration to said expanded configuration.

44. The motor (20) of claim 43, wherein said wheel member is a sprocket wheel (102g) selectively engaging complementary rollers (54) freely rollably mounted on said deformable chambers (30).

45. The motor (20) of claim 44, wherein said sprocket wheel (102g) is operatively connected to said shaft (24) so as to selectively actively deform said deformable chambers (30).

46. The motor (20) of claim 44, wherein said sprocket wheel is a first sprocket wheel (102), said wheel shaft being a first wheel shaft (104), said chamber collapsing means (40) including a second sprocket wheel (102g'), said second sprocket wheel (102g') freely rollably mounting on said structure (28) about a second wheel shaft (104'), said second wheel shaft (104') being substantially parallel to said shaft (24), said second sprocket wheel (102g') selectively engaging said rollers (54) of said deformable chambers (30) so as to selectively deform said deformable chambers (30) from said expanded configuration to said collapsed configuration.

47. The motor (20) of claim 20, wherein each of said chamber second ends (46) slidably mounts on corresponding said chamber first end (44), said chamber second end (46) sliding relative to said chamber first end (44) between first and second limit positions, said first and second limit positions corresponding to said expanded and collapsed configurations of said deformable chamber (30), respectively.

48. The motor (20) of claim 47, wherein each of said chamber first ends (44) defines a generally cylindrical-shaped sleeve (90), said cylindrical-shaped sleeve (90) defining a sleeve axis (92), a hollowed cylindrical peripheral

wall (94) and a longitudinal end wall (96), said sleeve axis (92) being generally radially oriented relative to said shaft (24), each of said chamber second ends (46) being a piston (98) slidably mounted within said peripheral wall (94).

49. The motor (20) of claim 48, wherein said peripheral wall (94) extends generally radially outwardly from corresponding said longitudinal end wall (96), said piston (98) being in proximity to and away from corresponding said longitudinal end wall (96) when in a first and a second limit position, respectively.

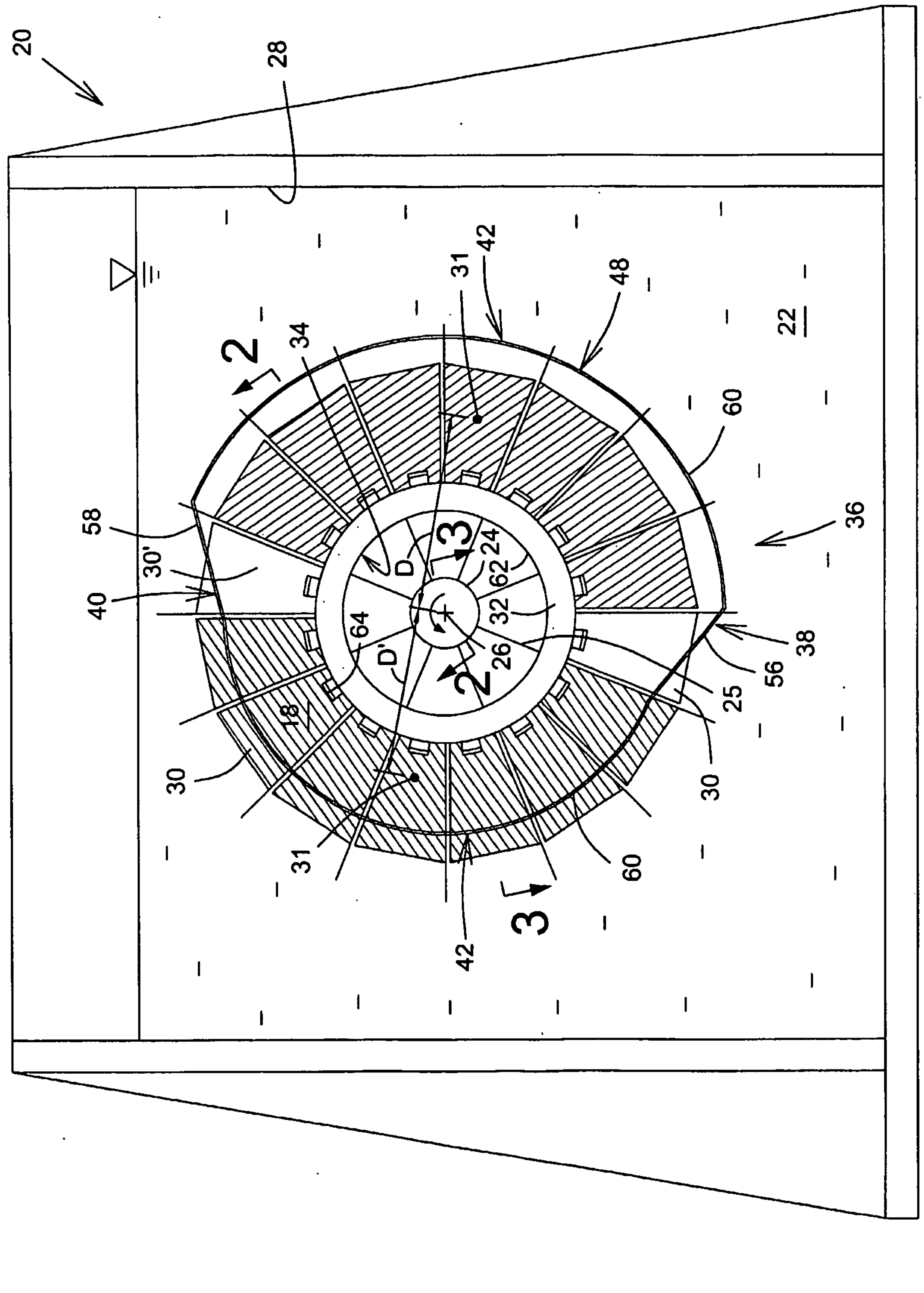
50. The motor (20) of claim 49, wherein said each of said connecting rods (70) generally extends through said longitudinal end walls (96) of said opposed deformable chambers (30, 30') of corresponding said chamber pair so as to connect to both said pistons (98) of said opposed deformable chambers (30, 30') and allow one of said pistons (98) to be in said first limit position while the other one of said pistons (98) is in said second limit position.

51. The motor (20) of claim 50, wherein said each of said connecting rods (70) is generally hollowed so as to be said chamber connecting means (34), each of said connecting rods (70) allowing fluid communication between said opposed deformable chambers (30, 30') of each said chamber pairs.

52. The motor (20) of claim 1, wherein each of said deformable chambers (30) defines a chamber first end (44) and a generally opposed chamber second end (46), said chamber deforming means (36) operatively connecting to at least one of said chamber first and second ends (44, 46) so as to selectively displace said chamber first and second ends (44, 46) generally away from and toward one another during upward and downward movement thereof, respectively.

53. The motor (20) of claim 52, wherein each of said chamber first ends (44) is pivotally connected to respective said chamber second end (46).

54. The motor (20) of claim 53, wherein said chamber first ends (44) are generally fixed relative to said shaft (24), said chamber second ends (46) operatively moving relative to corresponding said chamber first end (44).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D'
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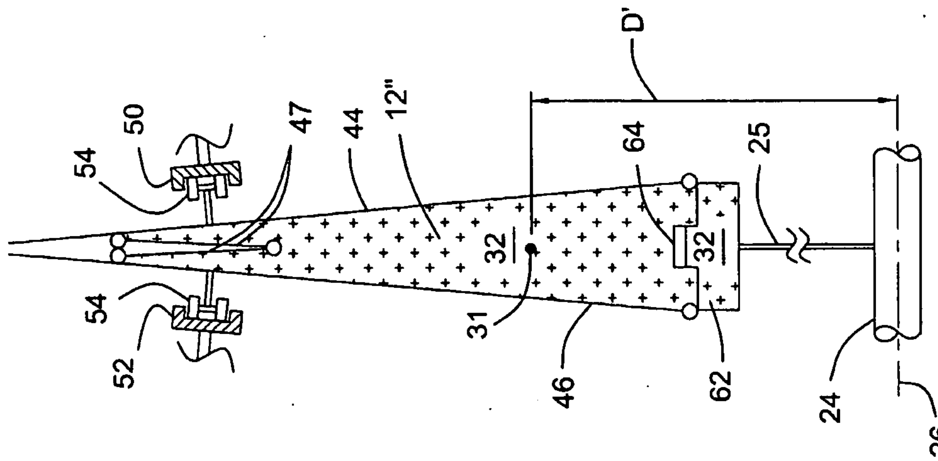
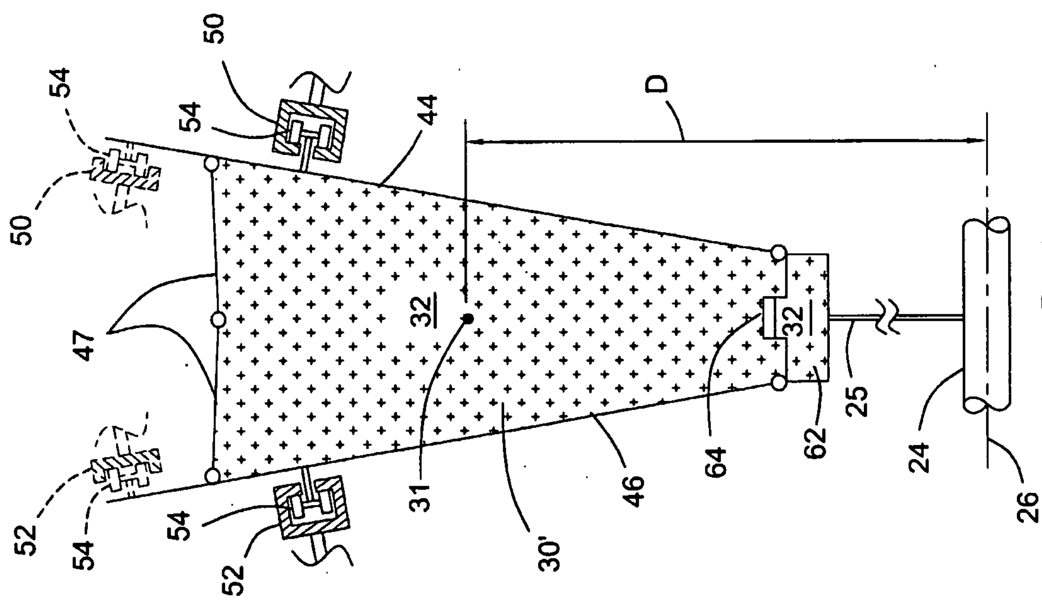
3

FIG.1



54
50
47
44
12"
D'
64
25
54
52
32
32
31
46
62
24
26

FIG.3



54
50
54
50
44
D
47
32
32
64
62
25
24
26
52
54
54
52
31
30'
46

FIG.2

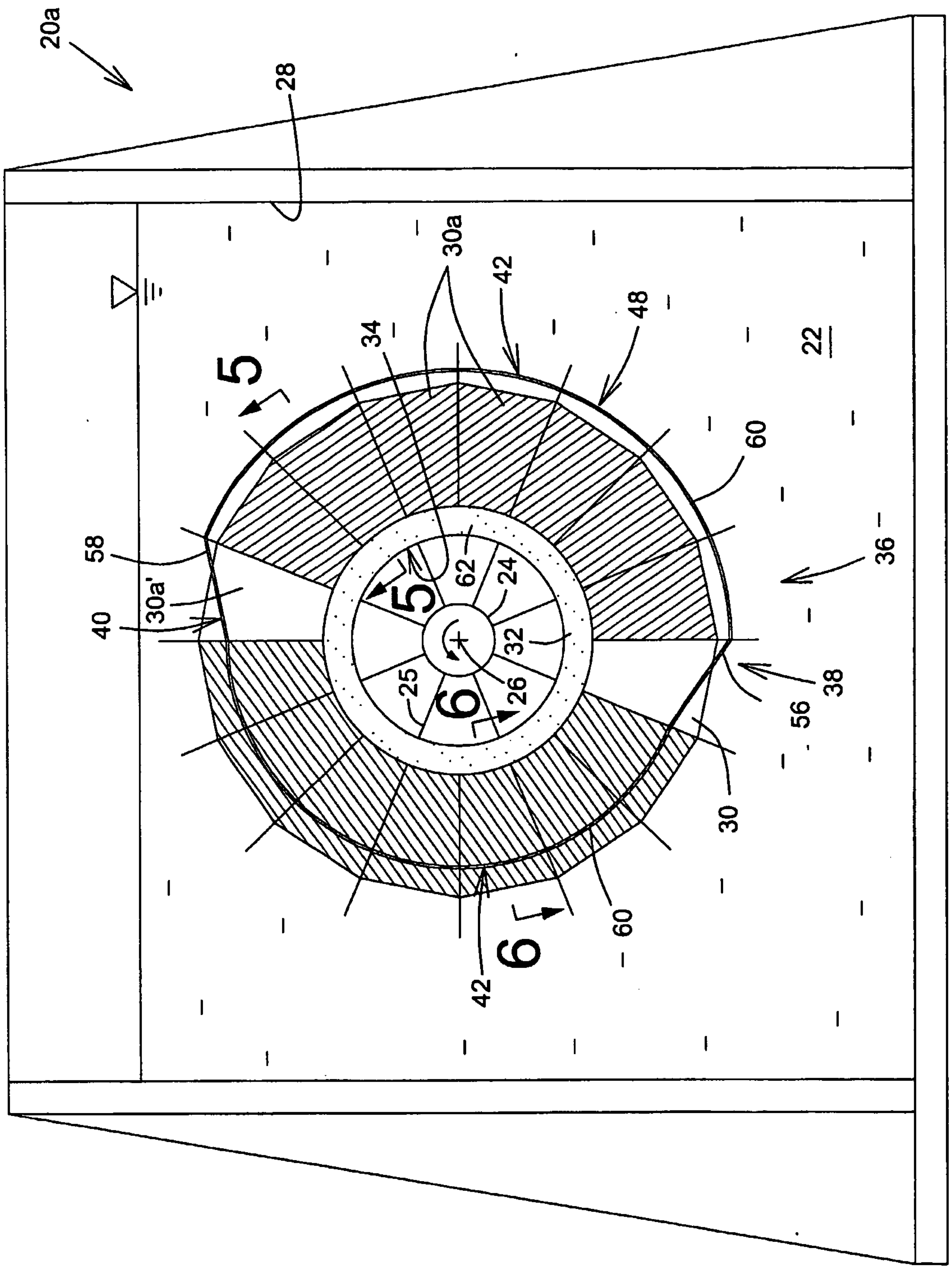


FIG.4

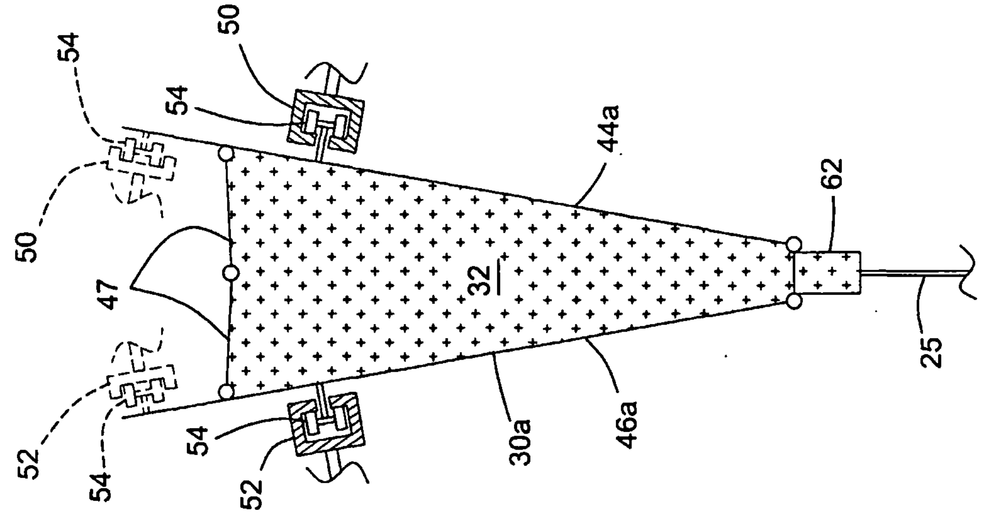

54
50
47
52
54
54
50
44a
32
62
25
30a
46a
54
52

FIG.5

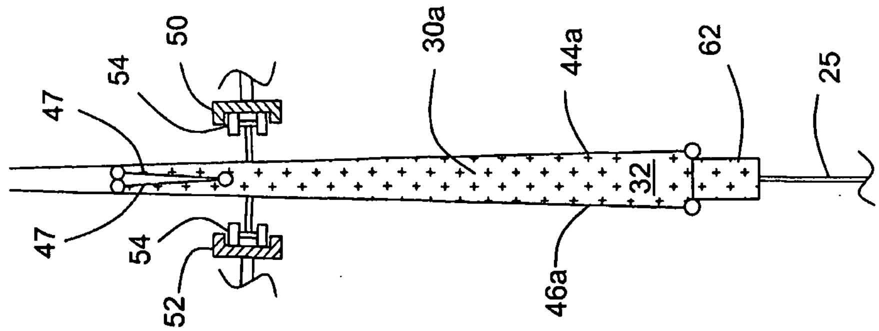

50
54
47
47
54
52
30a
44a
32
46a
62
25

FIG.6

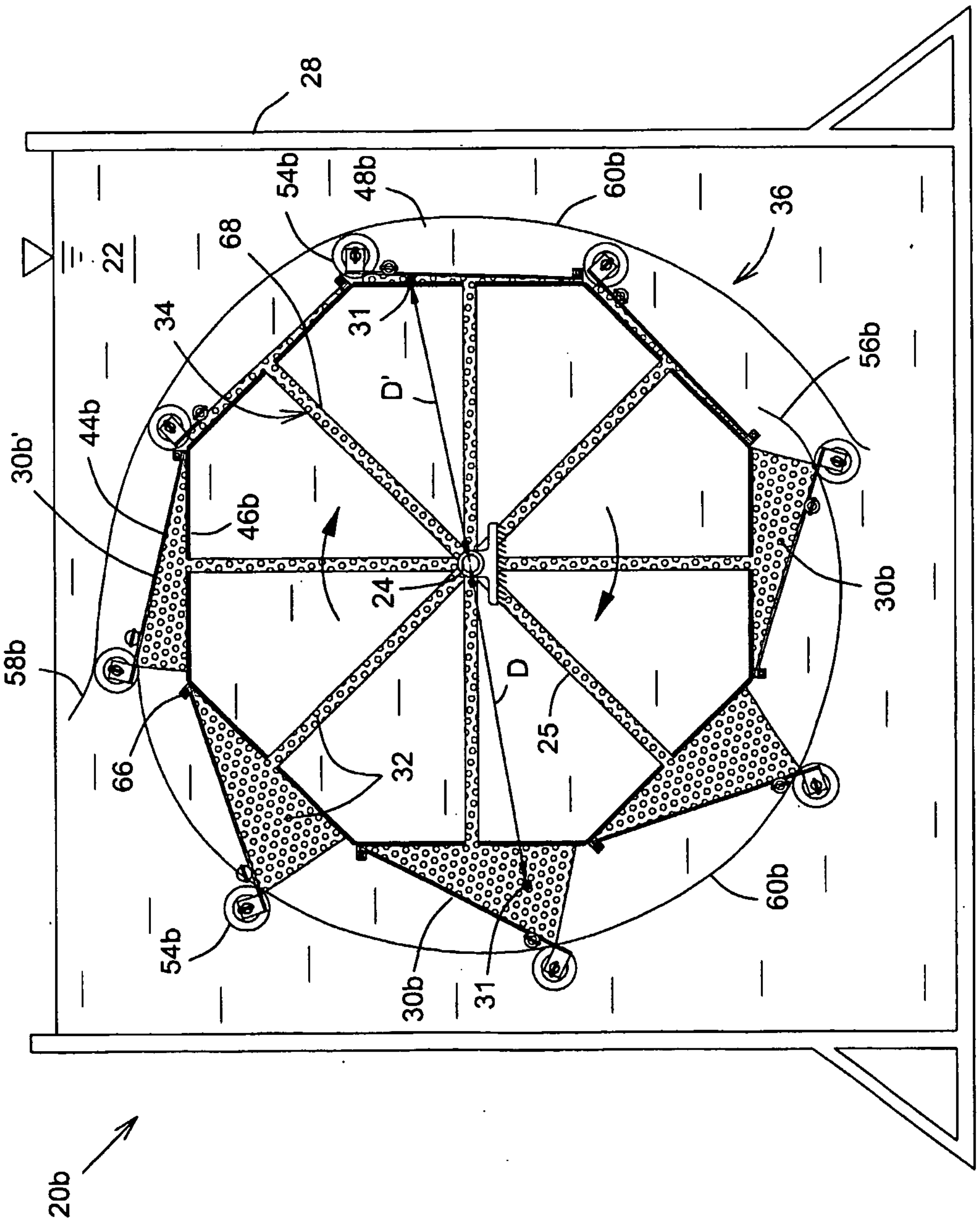

28
22
54b
48b
60b
36
68
31
34
56b
D'
44b
30b'
46b
24
30b
58b
D
25
66
32
54b
60b
30b
31
20b

FIG.7

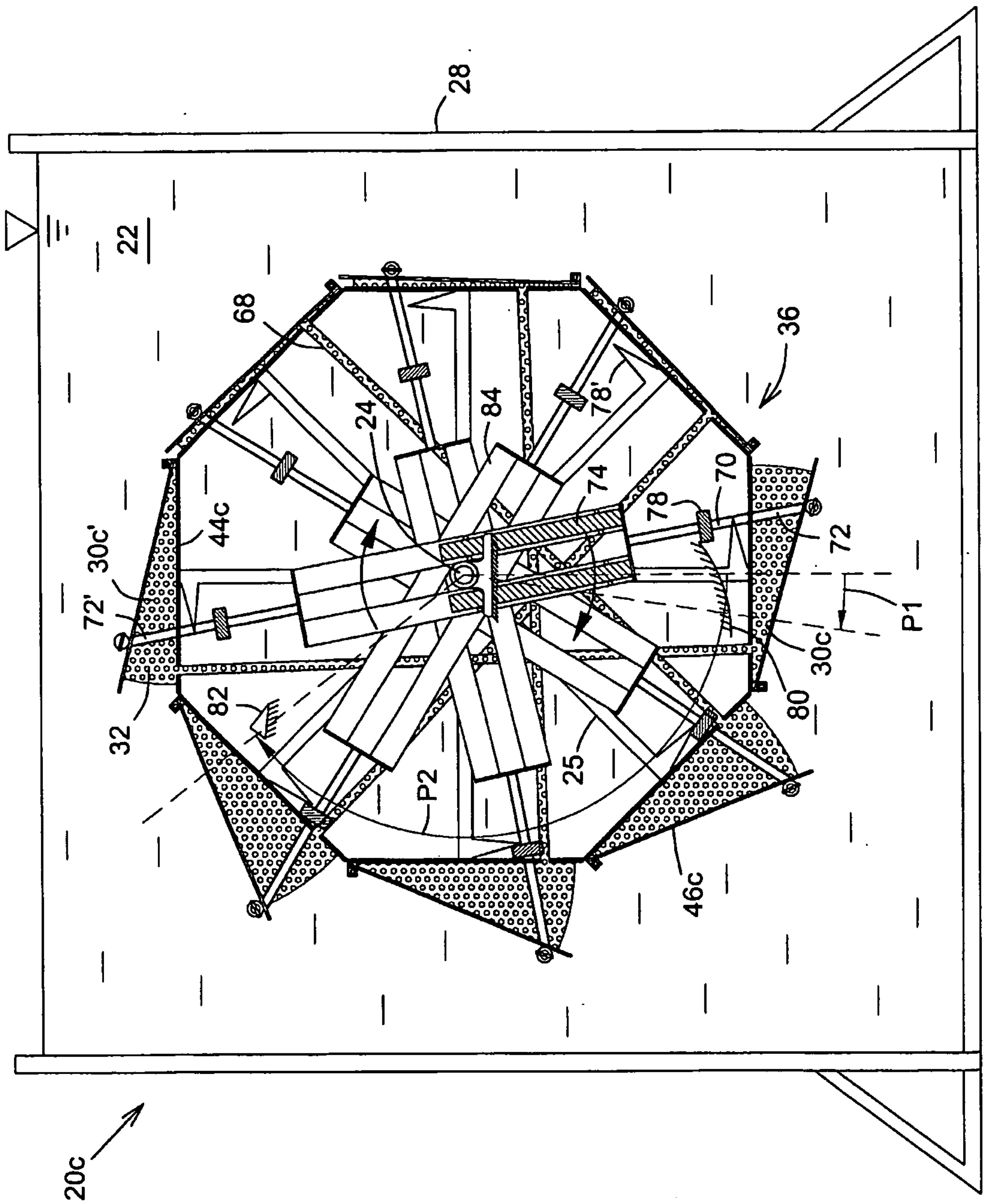

28
22
36
68
24
84
78'
74
70
78
72
44c
30c'
72'
P1
30c
80
82
32
P2
25
46c
20c

FIG.8

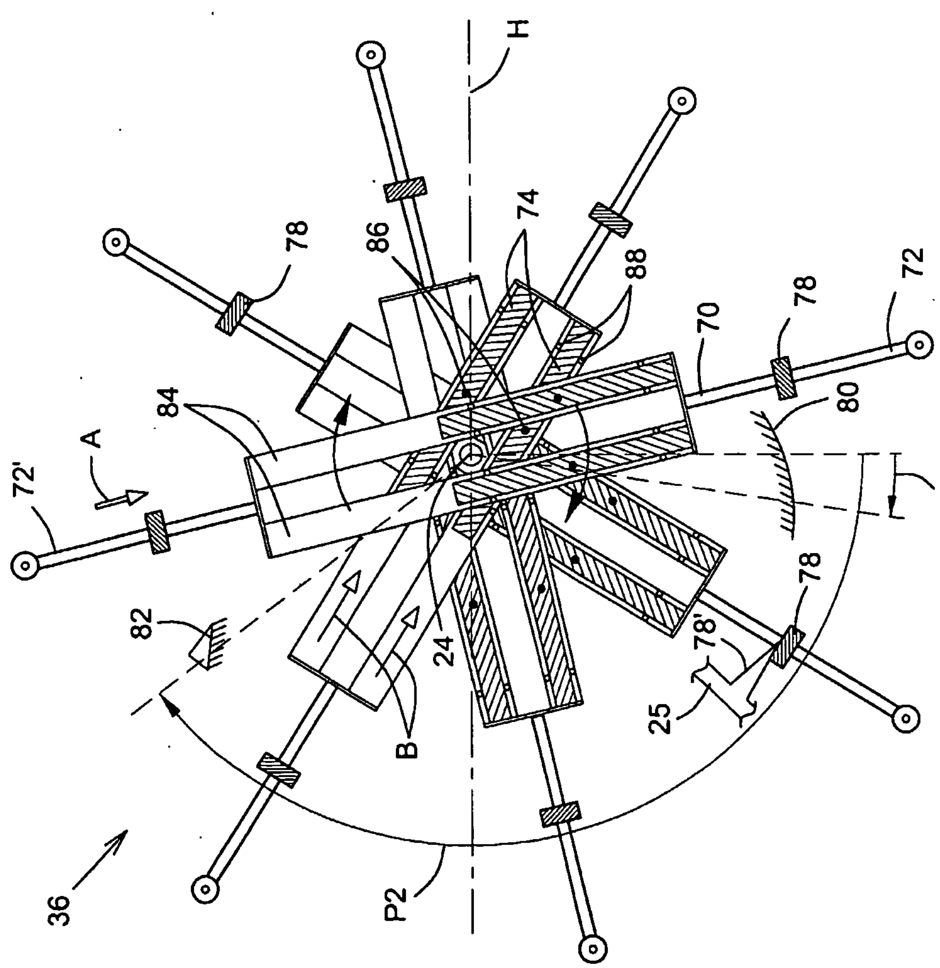


FIG.9

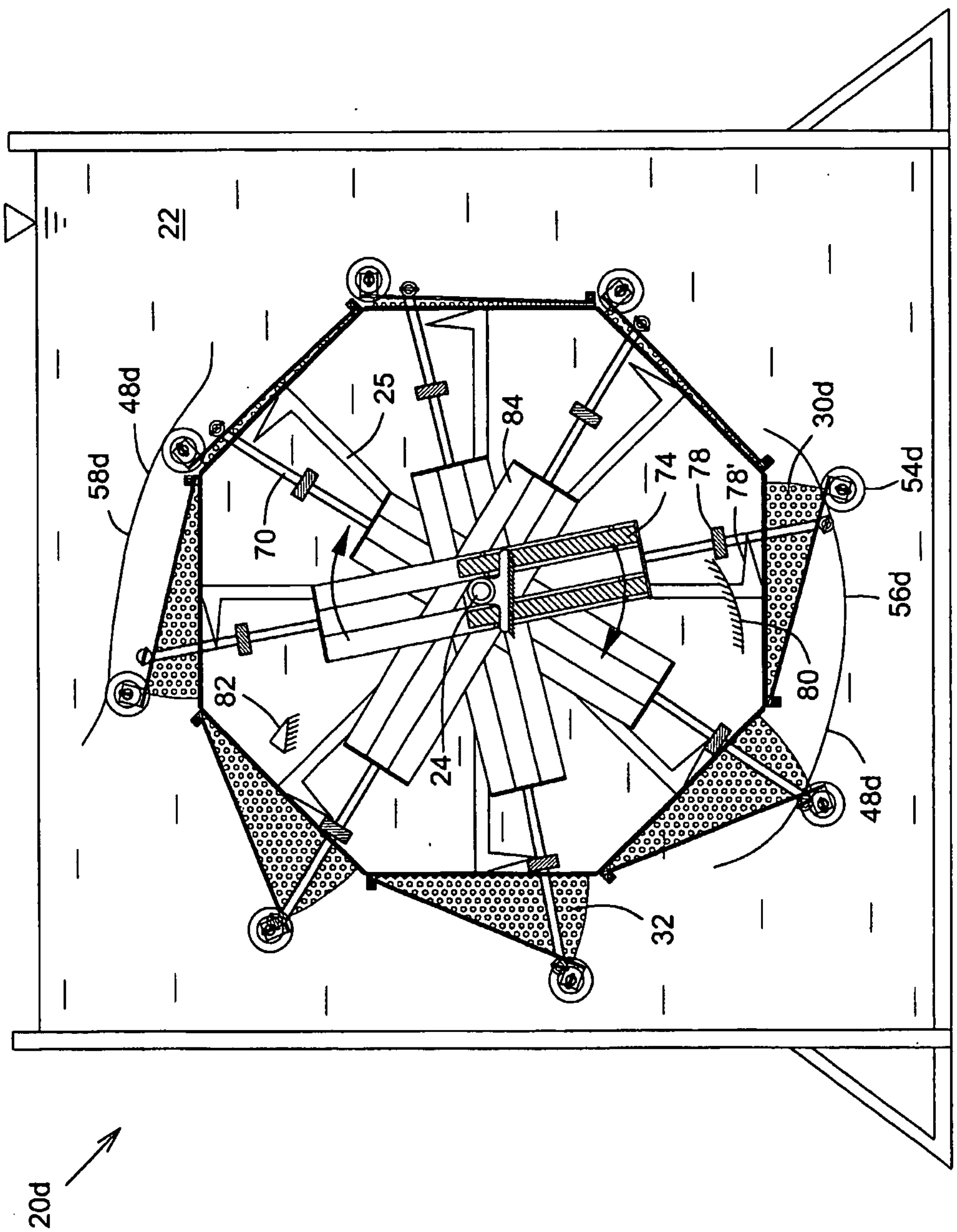


FIG.10

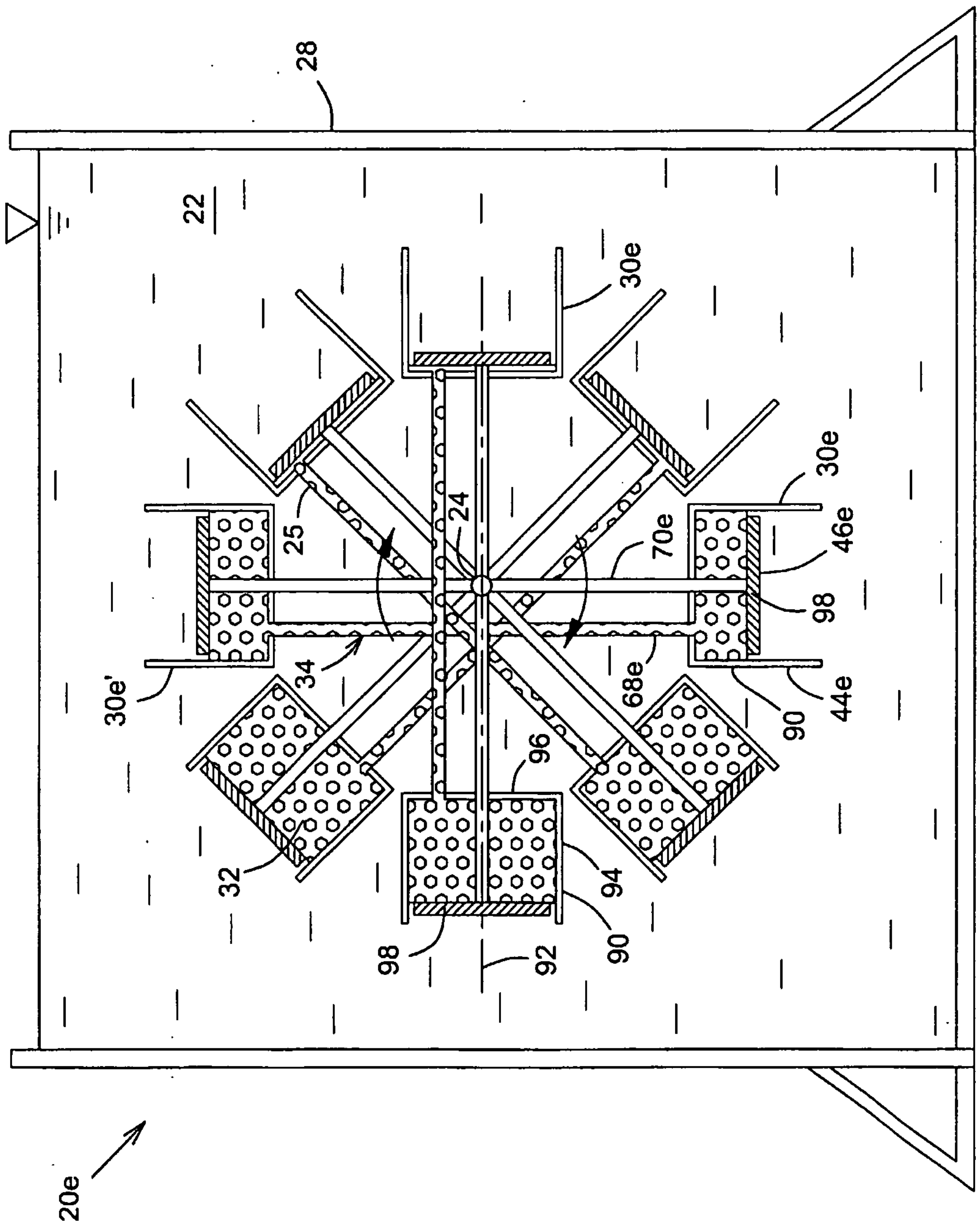

28
22
30e
30e
24
25
70e
46e
98
34
68e
30e'
90
44e
96
32
94
90
98
92
20e

FIG.11

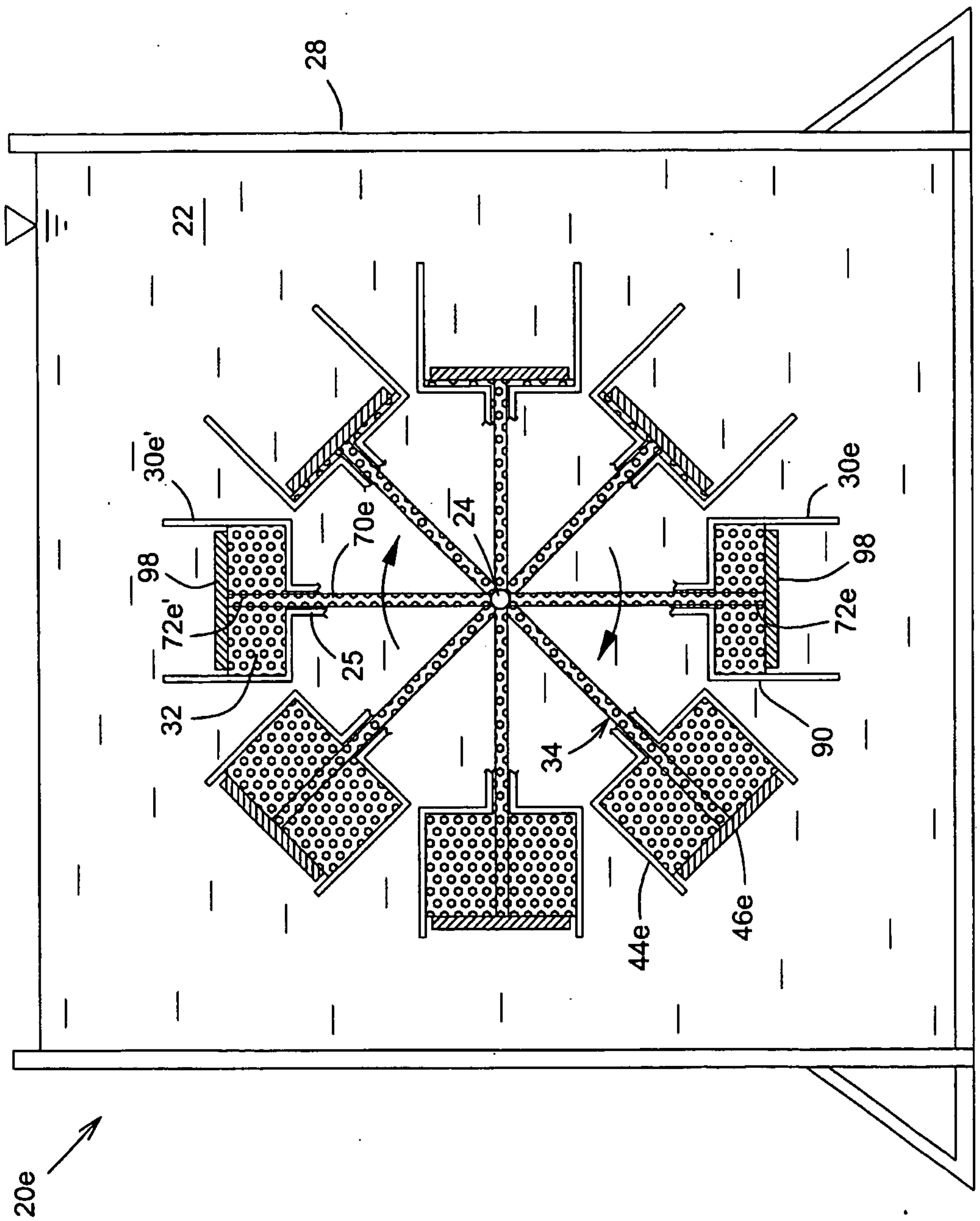


FIG.12

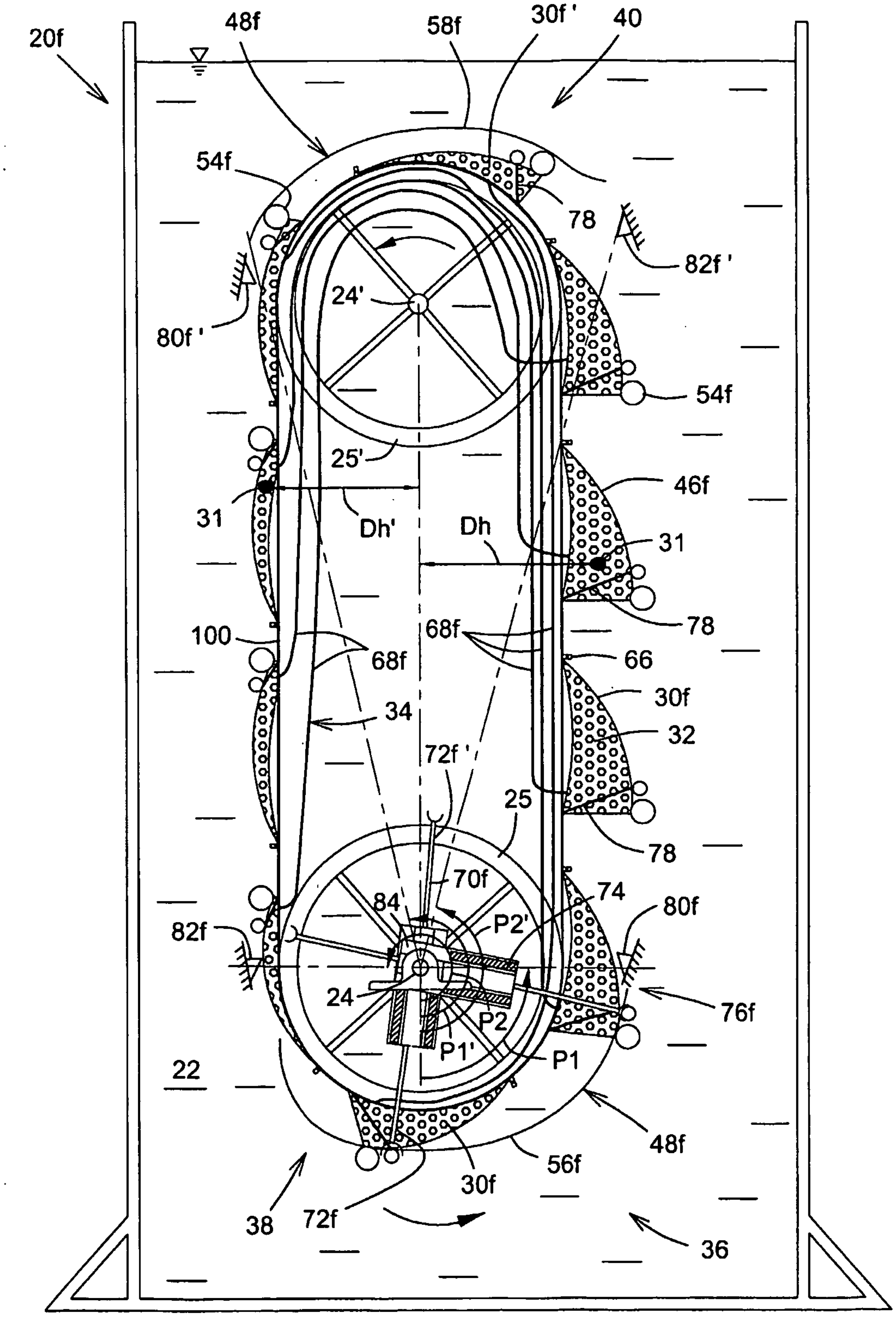

20f
48f
58f
30f '
40
54f
78
82f '
24'
80f '
54f
25'
46f
31
Dh'
Dh
31
78
100
68f
68f
66
30f
34
32
72f '
25
78
70f
74
84
P2'
80f
82f
24
76f
P2
P1'
P1
22
48f
56f
30f
38
72f
36

FIG.13

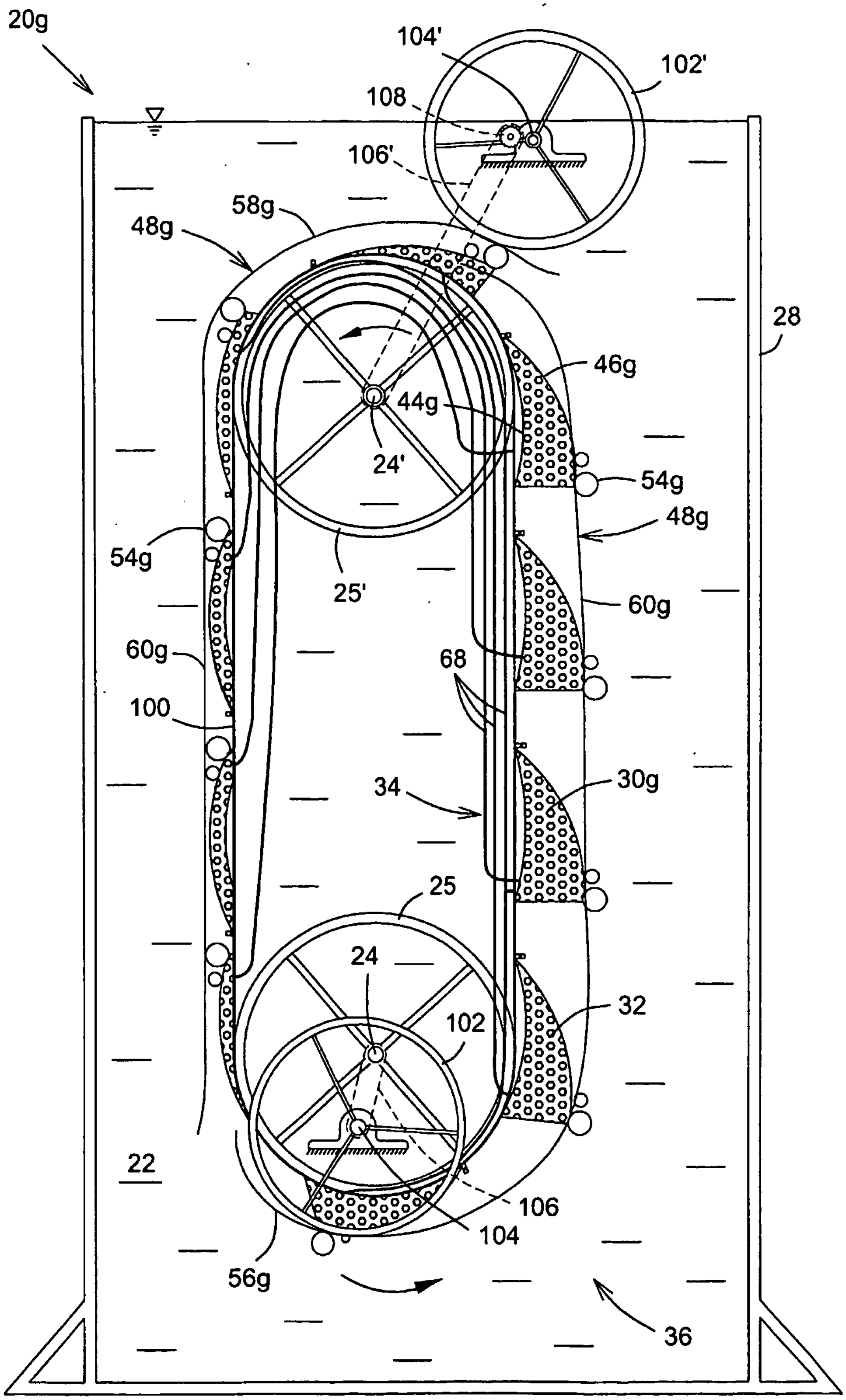

20g
104'
102'
108
106'
58g
48g
28
46g
44g
24'
54g
54g
48g
25'
60g
60g
68
100
34
30g
25
24
102
32
22
106
104
56g
36

FIG.14

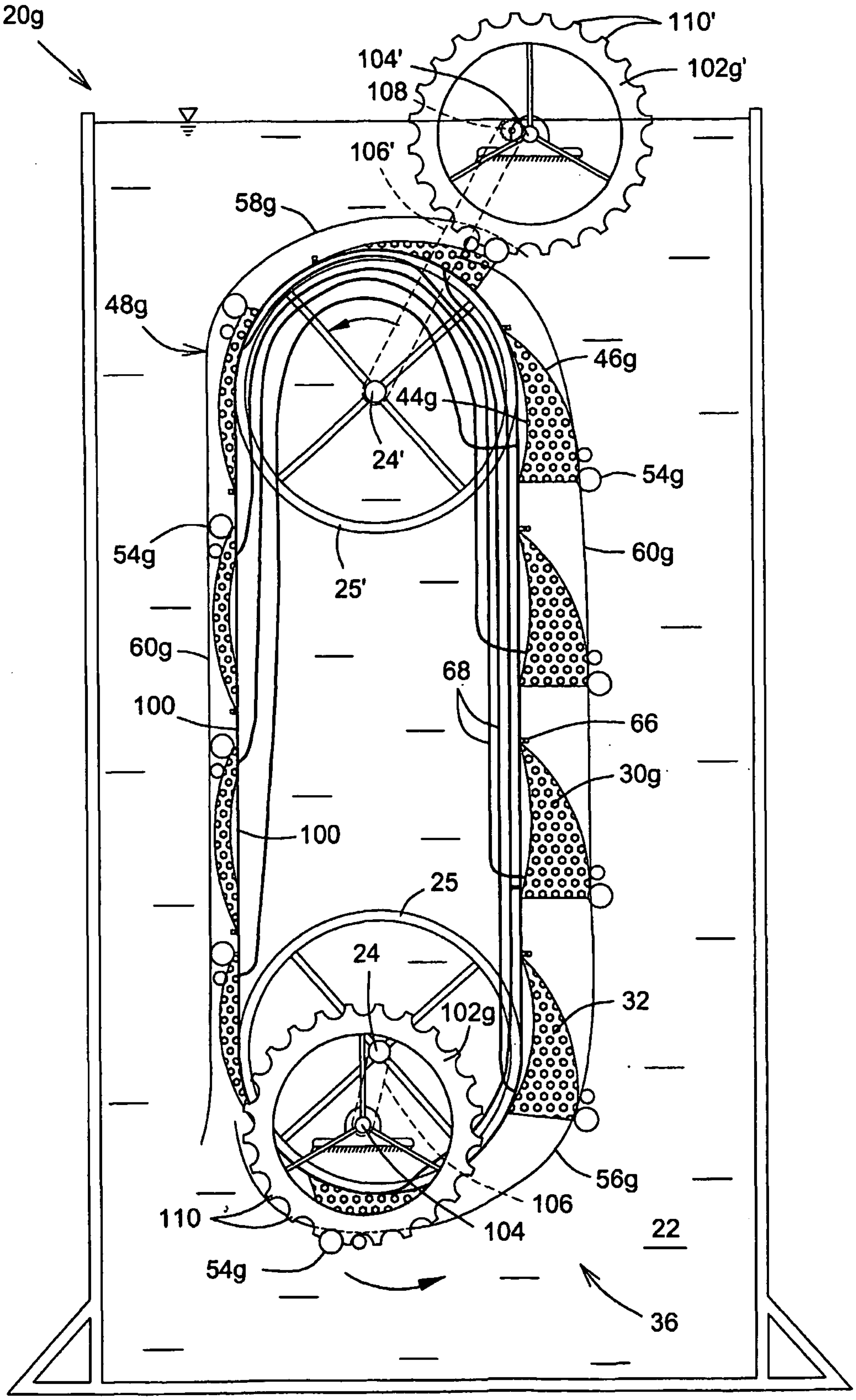

20g
110'
104'
102g'
108
106'
58g
48g
46g
44g
24'
54g
54g
60g
25'
60g
68
100
66
30g
100
25
24
102g
32
56g
106
110
104
22
54g
36

FIG.15